CHRONIFER® Special FM

1.4310/AISI 301-302 – Austenitic stainless steel, type 18/8

Features and Particularities

This austenitic stainless steel has a higher C and lower Ni contents as the 1.4301, 1. 4306 and 1.4107 grades. As a consequence, its austenitic structure is less stable and transforms rapidly into ferromagnetic α (Alpha) martensite under the plastic strains of a cold deformation. The high C content of this steel renders it more susceptible to sensitization and prone to intergranular corrosion after exposure in the critical temperature range of 440-850°C (400-900°C). Its corrosion resistance is similar to the corrosion resistance of the 1.4301 / AISI 304 steel. The CHRONIFER® Special FM steel can be used continuously up to 400°C. It contains both ∂ (Delta) ferrite and, if cold deformed, also α (Alpha) martensite. Both are ferromagnetic and do increase the magnetic relative permeability up to > 2.

Uses

The first use of this steel is for springs and spring components of all types. The typical fields of application are the beverage, food and chemical industries, as well as the micromechanical engineering. The corrosion resistance decreases with the applied cold deformation strength and the achieved surface quality and roughness.

Standards

Material number	1.4310
ISO	X10CrNi 18-8
EN/DIN	X10CrNi 18-8 8
AFNOR	X10CrNi 18-8 8 (former Z 11 CN 17-08/18-08/18-09)
AISI/SAE	≈ 301 / 302
ASTM	F899
NF	S 94-090
JIS	SUS 301

Chemical composition (%wt.)

C	Si	Mn	P	S	Cr	Ni	Mo	Cu	N	Fe
0.05	max.	max.	max.	max.	17.0	8.00	max.	max.	max.	balance
0.15	1.00	2.00	0.045	0.015	19.0	9.50	0.80	1.00	0.10	

Dimensions and Tolerances

Standard: Bars 3 m (+50/0 mm), coils for Escomatic

Strength UTS (MPa):	1350-2200, according to DIN 17224 and dimensions
• Bars Ø < 2.00 mm:	ISO h8
• Bars Ø ≥ 2.00 mm:	ISO h7 (h6)
• Wires Ø 0.80 - 3.00 mm:	ISO fg7, coils for Escomatic
• Out of roundness max.:	½ diameter tolerance

Other tolerances on request

Executions and Delivery conditions

Standard: Bars 3 m (+50/0 mm), coils for Escomatic

• Bars Ø ≥ 2.00 mm:	cold drawn, ground, polished, Ra max. (N5) Ends: pointed and chamfered
• Bars < 2.00 mm:	surface condition: cold drawn

Other executions on request

Availability

Standard dimensions on stock, see: Sale program

Cutting conditions

Machinability:	relatively difficult
Cutting speed:	V_c ≈ > 15-25 m/min, annealed UTS 550-650 MPa
Lubricant-coolant fluid:	individual choice

- The optimal cutting conditions depend on the machine tool, the cutting tools, the chip dimensions, the lubricant-cooling fluid, as well as the tolerances and surface the roughness to be achieved.

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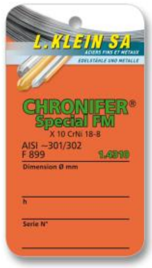

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δ (Delta) Ferrite

The CHRONIFER® Special D 18/8 steel contains ∂ (Delta) Ferrite. Its Ferrite content can be determined graphically with the Schaeffler-De Long Diagram modified by Outokumpu, or computed with the aid of the Cr_{eq} und Ni_{eq} equivalent contents:

- Cr_{eq} = 1.5Si + Cr + Mo + 2Ti + 0.5Nb
- Ni_{eq} = 30(C + N) + 0.5Mn + Ni + 0.5(Cu + Co)
- Ferrite Number FN or $\%_{vol.}$ δ (Delta) Ferrite
  FN = ([{1.375 (Cr_{ew} – 16} + 10] - Ne_{il}) 2.586

Negative values of FN indicate the absence of δ (Delta) Ferrite.

PREN

- PREN = %Cr + 3.3%Mo + 18%N
- Computed basic parameters: min. ≥ 17 / max. 23.4

Forming

Warm, forging: 950 – 1150°C, quenching/rapid cooling
Cold: no restriction

Anneal

Solution anneal: 1010-1090°C, quenching/rapid cooling

Hardening Strengthening

- This steel cannot be thermally hardened.
- This steel can be strengthened by cold deformation.

Microstructures

For machining and polishing: Austenite: annealed or cold deformed

Polishing

Mechanical and electro-polishing: adapted

- The ∂ (Delta) Ferrite present in this steel does not permit to achieve a mirror polishing.
- The ∂ (Delta) Ferrite is electro-polished in relief.

Welding

Relatively difficult

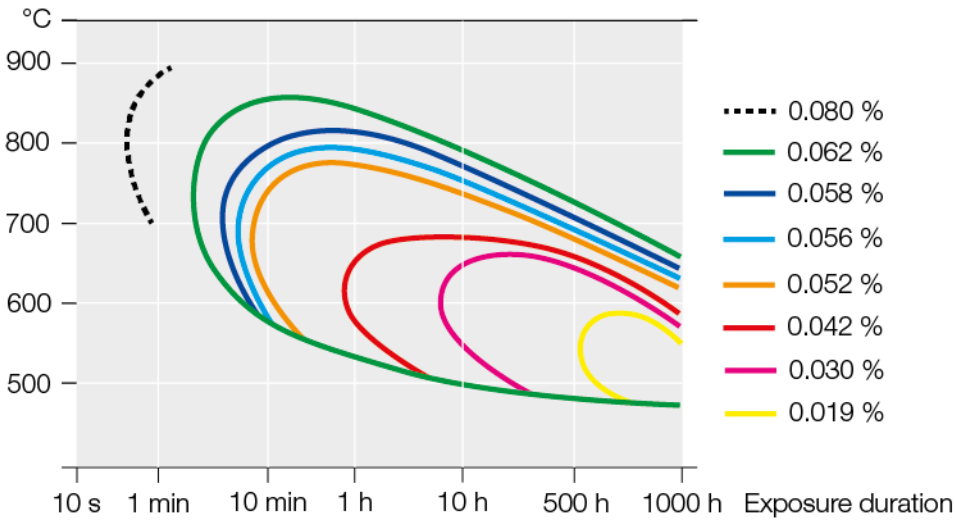
Laser Marking

- The HAZ Zone (Heat Affected Zone) of the laser marking can influence negatively its local microstructure. More info

Sensibilization

- This steel can be sensibilized by precipitation of intergranular carbides in the temperature range of 400-900°C. These precipitations provoke brittleness and intercristalline corrosion.

Sensibilization TTS curves



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Surface Oxidation

A thermal oxidation forms colored oxides or scaling on the surface. These muss be eliminated, is it chemically by pickling or by mechanical means like grinding.

- Colored surface oxidation and/or scaling can massively reduce the corrosion resistance.

Pickling - Passivation

The pickling and passivation processes and the products used therefore, should always be adapted to the requirements of the pickling and passivation of austenitic stainless steels. More info.

Corrosion resistance

- Optimal surface condition: Very clean, polished and passivized. More info.

Elementary precautions

- The most elementary protection is to always keep the surfaces very clean, polished and passivized.
- The parts should always be very well cleaned (no usage residual) and dried.
- Only use adapted chlorine free disinfection, cleaning and washing products.

More info.

Magnetism

Ferromagnetism due to the presence of ∂ (Delta) Ferrite:

- This steel can contain traces of ∂ (Delta) Ferrite and exhibit in the annealed condition values of its magnetic relative permeability µr >1.003.

Ferromagnetism due to the presence of α (Alpha) Martensite:

- This steel forms α (Alpha) ferromagnetic martensite during cold working. This ferromagnetism can exhibit relatively strong relative permeability values µr >2.

More info.

Physical properties

Properties	Unit	Temperature (°C)				
		20	200	300	400	500
Density	g cm^{-3}	7.95				
Young Modulus E	GPa	200	186	179	172	165
Poisson Coefficient		0.28				
Electrical resistance	Ω.mm^2.m^{-1}	0.73				
Thermal expansion	m m^{-1} K^{-1}	20–100°C	20–200°C	20–300°C	20–400°C	20–500°C
	10^{-6}	16.0	17.0	17.0	18.0	18.0
Thermal conductivity	W.m^{-1}.K^{-1}	15				
Specific heat	J.kg^{-1}.K^{-1}	500				
Melting range	°C	1400-1435				
Magnetism	from weak ferromagnetic in the annealed condition, to strongly ferromagnetic in the cold deformed condition					
Relative Permeability μ_r	< 1.02 in annealed condition > 2 in strong cold deformed condition (i.e. springs)					